

	Type	L #	Hits	Search Text	DBs
1	IS&R	L2	1550	((606/9-13) or (607/88-91)).CCLS.	USPAT
2	BRS	L3	1	1 and 2	USPAT
3	BRS	L1	11	(Sharon near2 Uzi).in.	USPAT; US-PGPUB ; EPO; JPO; DERWENT
4	BRS	L4	11	(Sharon near2 Uzi).in.	USPAT; US-PGPUB ; EPO; JPO; DERWENT; IBM_TDB
5	BRS	L5	6384	hair WITH (remove or removal)	USPAT; US-PGPUB ; EPO; JPO; DERWENT; IBM_TDB
6	BRS	L6	0	4 and 5	USPAT; US-PGPUB ; EPO; JPO; DERWENT; IBM_TDB
7	BRS	L7	109	2 and 5	USPAT; US-PGPUB ; EPO; JPO; DERWENT; IBM_TDB
8	BRS	L10	18	9 and (control or controller)	USPAT; US-PGPUB ; EPO; JPO; DERWENT; IBM_TDB

	Type	L #	Hits	Search Text	DBs
9	BRS	L11	15	10 and (focus or lens)	USPAT; US-PGPUB ; EPO; JPO; DERWENT; IBM_TDB
10	BRS	L12	9	("4492230"   "4887019"   "5125923"   "5219347"   "5360447"   "5364390"   "5411502"   "5480396"   "5533997") .PN.	USPAT
11	BRS	L13	19	("4733660"   "4750486"   "4941082"   "4945914"   "4973848"   "5178617"   "5336217"   "5344434"   "5474528"   "5474549"   "5501680"   "5531740"   "5544651"   "5546214"   "5558666"   "5588428"   "5595568"   "5599342"   "5618285") .PN.	USPAT

	Type	L #	Hits	Search Text	DBs
12	BRS	L9	21	8 and (image or imager)	USPAT; US-PGPUB ; EPO; JPO; DERWENT; IBM_TDB
13	BRS	L8	107	7 and laser	USPAT; US-PGPUB ; EPO; JPO; DERWENT; IBM_TDB
14	BRS	L15	2718	Sharon.in.	USPAT; US-PGPUB ; EPO; JPO; DERWENT
15	BRS	L16	0	1 and 5	USPAT; US-PGPUB ; EPO; JPO; DERWENT
16	BRS	L17	3	15 and 5	USPAT; US-PGPUB ; EPO; JPO; DERWENT
17	BRS	L18	0	200071045.URPN.	USPAT
18	BRS	L19	0	200071045.URPN.	USPAT
19	BRS	L20	5	2 and 15	USPAT; US-PGPUB ; EPO; JPO; DERWENT
20	IS&R	L21	269	(606/9).CCLS.	USPAT

	Type	L #	Hits	Search Text	DBs
21	IS&R	L22	2	(( "5531740" ) or ("5628744" ) ).PN.	USPAT

	1	Document ID	Title	Current OR
1	<input checked="" type="checkbox"/>	US 6383177 B1	Apparatus for tissue treatment	606/9
2	<input checked="" type="checkbox"/>	US 6383176 B1	Hair removal device and method	606/9
3	<input checked="" type="checkbox"/>	US 6328733 B1	Hand-held laser scanner	606/13
4	<input checked="" type="checkbox"/>	US 6273883 B1	Alexandrite laser system for treatment of dermatological specimens	606/9
5	<input checked="" type="checkbox"/>	US 6235015 B1	Method and apparatus for selective hair depilation using a scanned beam of light at 600 to 1000 nm	606/9
6	<input checked="" type="checkbox"/>	US 6162211 A	Skin enhancement using laser light	606/9
7	<input checked="" type="checkbox"/>	US 6104959 A	Method and apparatus for treating subcutaneous histological features	607/101
8	<input checked="" type="checkbox"/>	US 6074382 A	Apparatus for tissue treatment	606/9
9	<input checked="" type="checkbox"/>	US 5957915 A	Hand-held laser scanner	606/13
10	<input checked="" type="checkbox"/>	US 5938657 A	Apparatus for delivering energy within continuous outline	606/9

	<b>Inventor</b>
1	Balle-Petersen, Olav et al.
2	Connors, Kevin P. et al.
3	Trost, David
4	Furumoto, Horace W.
5	Mead, III, Douglass S. et al.
6	Tankovich, Nikolai I. et al.
7	Spertell, Robert Bruce
8	Asah, Bjarne et al.
9	Trost, David
10	Assa, Shlomo et al.

	1	Document ID	Title	Current OR
11	<input checked="" type="checkbox"/>	US 5743902 A	Hand-held laser scanner	606/18
12	<input checked="" type="checkbox"/>	US 5595568 A	Permanent hair removal using optical pulses	606/9
13	<input checked="" type="checkbox"/>	US 6306128 B1	Cooling apparatus for cutaneous treatment employing a laser and method for operating same	606/9
14	<input checked="" type="checkbox"/>	US 6273885 B1	Handheld photoepilation device and method	606/9
15	<input checked="" type="checkbox"/>	US 6248103 B1	Apparatus and method for dynamic cooling of biological tissues for thermal mediated surgery using long laser pulses	606/9
16	<input checked="" type="checkbox"/>	US 6080147 A	Method of employing a flashlamp for removal of hair, veins and capillaries	606/9
17	<input checked="" type="checkbox"/>	US 5879346 A	Hair removal by selective photothermolysis with an alexandrite laser	606/9
18	<input checked="" type="checkbox"/>	US 5868732 A	Cooling apparatus for cutaneous treatment employing a laser and method for operating same	606/9
19	<input checked="" type="checkbox"/>	US 5683380 A	Method and apparatus for depilation using pulsed electromagnetic radiation	606/9

	<b>Inventor</b>
11	Trost, David
12	Anderson, R. Rox et al.
13	Waldman, Amir et al.
14	Koop, Dale E. et al.
15	Tannenbaum, Sam et al.
16	Tobinick, Edward L.
17	Waldman, Amir et al.
18	Waldman, Amir et al.
19	Eckhouse, Shimon et al.



	1	Document ID	Title	Current OR
20	<input checked="" type="checkbox"/>	US 5628744 A	Treatment beam handpiece	606/12
21	<input checked="" type="checkbox"/>	WO 200071045 A	Laser system for skin treatment, has controller to regulate laser to irradiate pulsed laser light towards spot located on skin through optical system	
22	<input checked="" type="checkbox"/>	US 6032071 A	Skin examination device	600/476
23	<input checked="" type="checkbox"/>	US 5860967 A	Dermatological laser treatment system with electronic visualization of the area being treated	606/9
24	<input checked="" type="checkbox"/>	US 5820625 A	Light depilating apparatus	606/9
25	<input checked="" type="checkbox"/>	US 5738679 A	Apparatus for laser treatment for living tissue	606/11
26	<input checked="" type="checkbox"/>	US 5735844 A	Hair removal using optical pulses	606/9
27	<input checked="" type="checkbox"/>	US 4617926 A	Depilation device and method	606/9

	<b>Inventor</b>
20	Coleman, Tony D. et al.
21	SHARON, U
22	Binder, Michael
23	Zavislan, James M. et al.
24	Izawa, Yoshihiro et al.
25	Daikuzono, Norio
26	Anderson, R. Rox et al.
27	Sutton, A. Gunilla

	1	Document ID	Title	Current OR
1	<input checked="" type="checkbox"/>	US 6383177 B1	Apparatus for tissue treatment	606/9
2	<input checked="" type="checkbox"/>	US 6383176 B1	Hair removal device and method	606/9
3	<input checked="" type="checkbox"/>	US 6328733 B1	Hand-held laser scanner	606/13
4	<input checked="" type="checkbox"/>	US 6273883 B1	Alexandrite laser system for treatment of dermatological specimens	606/9
5	<input type="checkbox"/>	US 6261310 B1	Laser safe treatment system	607/89
6	<input checked="" type="checkbox"/>	US 6235015 B1	Method and apparatus for selective hair depilation using a scanned beam of light at 600 to 1000 nm	606/9
7	<input type="checkbox"/>	US 6165170 A	Laser dermablator and dermablation	606/9
8	<input checked="" type="checkbox"/>	US 6162211 A	Skin enhancement using laser light	606/9
9	<input checked="" type="checkbox"/>	US 6104959 A	Method and apparatus for treating subcutaneous histological features	607/101
10	<input checked="" type="checkbox"/>	US 6074382 A	Apparatus for tissue treatment	606/9

	<b>Inventor</b>
1	Balle-Petersen, Olav et al.
2	Connors, Kevin P. et al.
3	Trost, David
4	Furumoto, Horace W.
5	Neuberger, Wolfgang et al.
6	Mead, III, Douglass S. et al.
7	Wynne, James Jeffrey et al.
8	Tankovich, Nikolai I. et al.
9	Spertell, Robert Bruce
10	Asah, Bjarne et al.

	1	Document ID	Title	Current OR
11	<input checked="" type="checkbox"/>	US 5957915 A	Hand-held laser scanner	606/13
12	<input checked="" type="checkbox"/>	US 5938657 A	Apparatus for delivering energy within continuous outline	606/9
13	<input type="checkbox"/>	US 5824023 A	Radiation-delivery device	607/88
14	<input checked="" type="checkbox"/>	US 5743902 A	Hand-held laser scanner	606/18
15	<input type="checkbox"/>	US 5519534 A	Irradiance attachment for an optical fiber to provide a uniform level of illumination across a plane	359/599

	<b>Inventor</b>
11	Trost, David
12	Assa, Shlomo et al.
13	Anderson, Richard Rox
14	Trost, David
15	Smith, Paul D. et al.



US005993440A

**United States Patent** [19]  
**Ghassemi**[11] **Patent Number:** **5,993,440**[45] **Date of Patent:** **Nov. 30, 1999**[54] **NON-INVASIVE LASER CUTTING DEVICE  
AND METHOD**[76] **Inventor:** **Faramarz Frank Ghassemi, 6553  
Timber Ct., San Jose, Calif. 95120**[21] **Appl. No.:** **09/027,145**[22] **Filed:** **Feb. 20, 1998****Related U.S. Application Data**[60] **Provisional application No. 60/062,062, Oct. 16, 1997.**[51] **Int. Cl.<sup>6</sup>** ..... **A61N 5/00; A61B 17/36;  
B26B 19/44**[52] **U.S. Cl.** ..... **606/9; 30/41.5**[58] **Field of Search** ..... **606/9, 13, 16,  
606/17, 27, 28, 32, 36, 37, 45, 48, 51;  
30/41.5, 41.6**[56] **References Cited****U.S. PATENT DOCUMENTS**

D. 368,962	4/1996	Tahriri .	
3,693,623	9/1972	Harte et al. ....	606/9
4,498,474	2/1985	Chalmers et al. ....	606/36
4,617,926	10/1986	Sutton .....	606/9
4,784,136	11/1988	Klein .....	606/36
5,182,857	2/1993	Simon .....	30/34.05
5,221,280	6/1993	Gross et al. ....	606/36
5,364,394	11/1994	Mehl .....	606/36
5,376,088	12/1994	Glaros .....	606/36
5,419,344	5/1995	Dewitt .	
5,425,728	6/1995	Tankovich .....	606/9
5,533,266	7/1996	Kelman .....	30/122
5,595,568	1/1997	Anderson .....	606/9

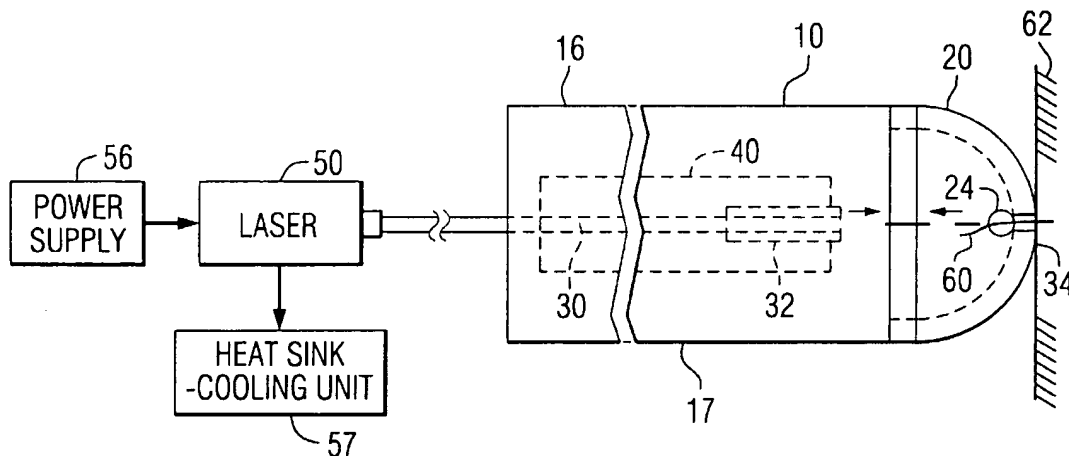
5,606,798	3/1997	Kelman .....	30/41.5
5,662,894	9/1997	McManus .	
5,820,625	10/1998	Izawa et al. ....	606/9

**OTHER PUBLICATIONS**

Pages of Computer Printout Containing Abstracts of Patents to Kelman No. EP 96102708; GB 09502064; GB 0950220; GB 09200426; EP 96102708A; GB 09502064W; GB 09501220W; GB 09200426W.

*Primary Examiner*—Linda C. M. Dvorak*Assistant Examiner*—Sonya C Harris-Ogugua*Attorney, Agent, or Firm*—Charles E. Wands[57] **ABSTRACT**

A hand-held, non-invasive cutting device is configured to cut a fiber-like element, such as animal or human hair projecting from the surface of a medium, such as body skin, without exposing the user to the cutting beam. The device exterior is shaped to be readily placed against the surface of the body and has an aperture that accommodates passage of the hair to be cut into an interior region of the housing. The housing includes an optical energy beam director that directs a beam of optical energy, such as a laser beam generated by an external or internal laser, through an interior cutting zone, and onto the inserted element, thereby severing or vaporizing the element. Because the laser beam is aligned with and parallel to the longitudinal direction of the cutting window, then regardless of where it is inserted in the cutting window, the element will be cut by the laser beam. In addition, the beam cannot exit the cutting window, so that the invention is non-invasive and safe for consumer use.

**16 Claims, 3 Drawing Sheets**

**United States Patent** [19]**Sutton**[11] **Patent Number:** **4,617,926**[45] **Date of Patent:** **Oct. 21, 1986**[54] **DEPILATION DEVICE AND METHOD**

[76] **Inventor:** A. Gunilla Sutton, 19, Tregunter Road, London SW10, United Kingdom

[21] **Appl. No.:** 574,922[22] **Filed:** Jan. 30, 1984[51] **Int. Cl.<sup>4</sup>** ..... A61N 5/00[52] **U.S. Cl.** ..... 128/303.1; 128/355; 128/398; 350/96.1; 350/96.18[58] **Field of Search** ..... 128/303.1, 395-398, 128/355; 219/121 LA; 350/96.1, 96.18, 96.29, 96.30, 96.32[56] **References Cited****U.S. PATENT DOCUMENTS**

3,404,350 10/1968 Muncheryan ..... 219/121 LA  
 3,538,919 11/1970 Meyer ..... 128/398  
 3,693,623 9/1972 Harte et al. .... 128/398  
 3,712,986 1/1973 Collings ..... 350/96.29 X  
 3,834,391 9/1974 Block ..... 128/303.1

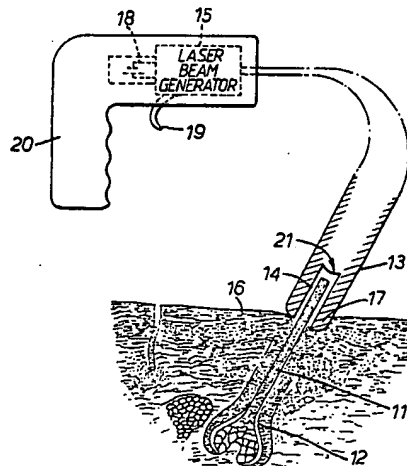
3,843,865 10/1974 Nath ..... 128/395 X  
 3,999,552 12/1976 Huggins ..... 128/303.13  
 4,388,924 6/1983 Weissman et al. .... 128/303.1

**FOREIGN PATENT DOCUMENTS**

1041610 10/1978 Canada ..... 128/303.1

*Primary Examiner*—Lee S. Cohen*Attorney, Agent, or Firm*—Ralph R. Rath[57] **ABSTRACT**

A depilation device includes a laser beam generator 15 embodied in a hand gun 20 with a trigger 19 enabling pulses of laser energy to be delivered along a flexible fibre optic probe 13 which has a bore in the end which can fit over a hair to be destroyed. At the end of the bore, the optic is formed as a convex lens so that the pulses of energy are focused into the hair so that the hair and follicle can be destroyed without destroying surrounding tissue.

**12 Claims, 2 Drawing Figures**





US006015404A

**United States Patent** [19]

Altshuler et al.

[11] Patent Number: **6,015,404**[45] Date of Patent: **\*Jan. 18, 2000****[54] LASER DERMATOLOGY WITH FEEDBACK CONTROL**

[75] Inventors: **Gregory Altshuler**, Beverly, Mass.;  
**Andrei V. Erofeev**, St. Petersburg,  
Russian Federation

[73] Assignee: **Palomar Medical Technologies, Inc.**,  
Burlington, Mass.

[\*] Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

[21] Appl. No.: **08/759,036**

[22] Filed: **Dec. 2, 1996**

[51] Int. Cl.<sup>7</sup> ..... **A61N 5/06**

[52] U.S. Cl. .... **606/9; 606/10**

[58] Field of Search ..... **606/2, 3, 4, 5,**  
**606/6, 10, 11, 12, 14, 15, 16, 17, 19**

**[56] References Cited****U.S. PATENT DOCUMENTS**

5,057,104	10/1991	Chess	606/9
5,071,417	12/1991	Sinofsky	606/8
5,137,530	8/1992	Sand	606/5
5,140,984	8/1992	Dew et al.	606/2 X
5,207,671	5/1993	Franken et al.	606/9
5,334,191	8/1994	Poppas et al.	606/12
5,334,193	8/1994	Nardella	606/41
5,344,418	9/1994	Ghaffari	609/9
5,348,551	9/1994	Spears et al.	606/5
5,350,376	9/1994	Brown	606/12
5,415,654	5/1995	Daikuzono	606/13
5,782,249	7/1998	Weber et al.	606/16

**FOREIGN PATENT DOCUMENTS**

0 755 698 A2 1/1997 European Pat. Off. .  
38 37 248 3/1990 Germany .  
WO 96/25979 8/1996 WIPO .

**OTHER PUBLICATIONS**

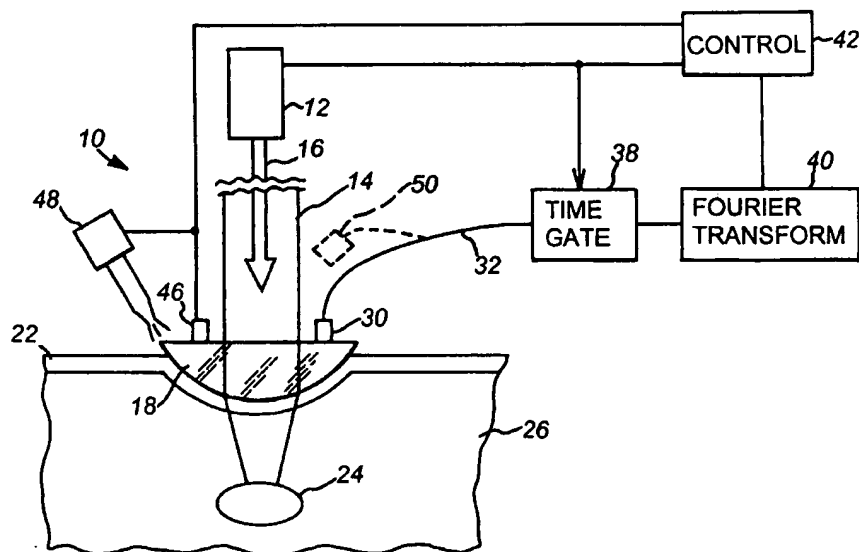
Belikov, A. V., A. G. Novikov and A. V. Scrypnik, "Identification of enamel and dentine under tooth laser treatment" *SPIE*, 2623:109-116, 1995.

Altshuler, G. B., et al., "Acoustic response of hard dental tissues to pulsed laser action." *SPIE*, 2080:97-103, 1993.

Primary Examiner—Robert L. Nasser  
Attorney, Agent, or Firm—Wolf, Greenfield & Sacks, P.C.

**[57] ABSTRACT**

Method and apparatus are provided for use with systems applying laser energy to treat a selected dermatology problem. The method and apparatus protect skin not under treatment in skin regions affected by the laser by detecting, with a suitable sensor, at least a selected parameter in the skin region affected by the delivered laser energy and performing a control function to effect the desired protection by use of a feedback mechanism which is operative in response to an output from the sensor. For some embodiments, two laser pulses may be utilized, which pulses are spaced by a time which is preferably greater than the thermal relaxation time for affected regions not under treatment, for example an epidermis through which the energy is passed to an area under treatment, but is less than the thermal relaxation time of the area under treatment. The first of the pulses serves as a prediagnosis pulse which is clearly below the damage threshold for protected areas, with the sensor output for the first pulse being utilized to control at least one parameter of the second pulse.

**9 Claims, 4 Drawing Sheets**



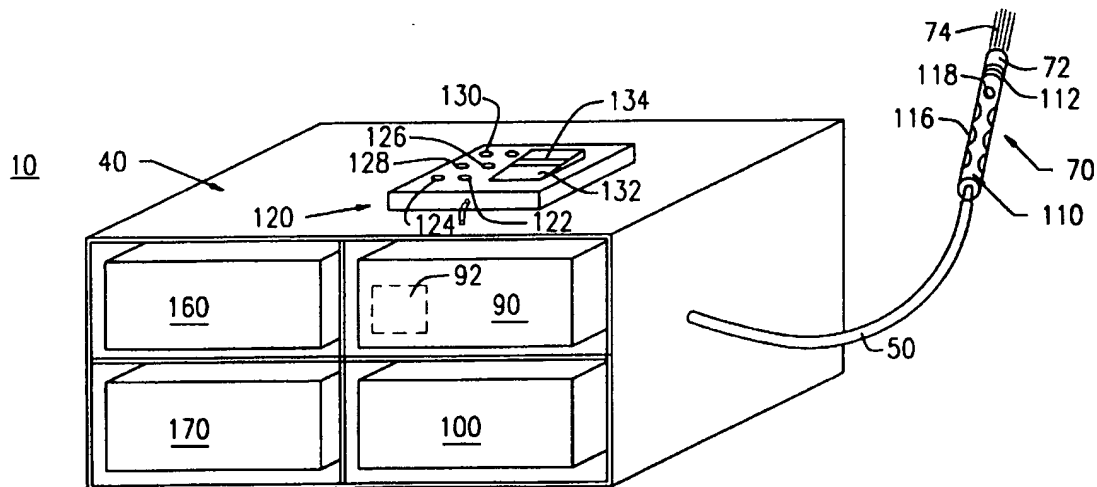
US006080147A

**United States Patent** [19]  
**Tobinick****[11] Patent Number: 6,080,147**  
**[45] Date of Patent: Jun. 27, 2000****[54] METHOD OF EMPLOYING A FLASHLAMP  
FOR REMOVAL OF HAIR, VEINS AND  
CAPILLARIES***Primary Examiner—Linda C. M. Dvorak*  
*Assistant Examiner—Roy Gibson*  
*Attorney, Agent, or Firm—Ezra Sutton***[76] Inventor: Edward L. Tobinick, 100 UCLA  
Medical Plaza Suite 205, Los Angeles,  
Calif. 90024-6903****[57] ABSTRACT**

A method of removing hair or blood vessels from the skin of a patient using a flashlamp, a sequence control device and an optical delivery system, and includes the steps of controlling the flashlamp to sequentially emit a series of pulses of incoherent light energy, transmitting the series of pulses of incoherent light energy through the optical delivery system to the same spot on the skin containing the hair or blood vessels with the sequential pulses of incoherent light energy transmitted through the optical delivery system from the flashlamp, and pulsing the flashlamp at least two times at a wavelength in the range 550 to 1200 nm, at a power level in the range of 4 to 25 Joules/cm<sup>2</sup>, each pulse having a duration in the range of 1/2 to 10 milliseconds, a delay between pulses in the range of 1 to 10 milliseconds, and having a beam diameter on the treatment area in the range of 4 to 50 millimeters.

**[21] Appl. No.: 09/095,630****[22] Filed: Jun. 10, 1998****[51] Int. Cl.<sup>7</sup> ..... A61B 17/52****[52] U.S. Cl. .... 606/9; 606/2; 606/10;  
606/13****[58] Field of Search ..... 606/9, 2, 3, 10-14;  
607/89, 100****[56] References Cited****U.S. PATENT DOCUMENTS**

4,608,978	9/1986	Rohr	606/9
5,755,751	5/1998	Eckhouse	607/88
5,885,273	3/1999	Eckhouse et al.	606/9
5,885,274	3/1999	Fullmer et al.	606/9

**8 Claims, 5 Drawing Sheets**



US005464436A

**United States Patent** [19]  
**Smith**

[11] **Patent Number:** **5,464,436**  
 [45] **Date of Patent:** **Nov. 7, 1995**

[54] **METHOD OF PERFORMING LASER THERAPY**

[75] **Inventor:** Chadwick F. Smith, Rolling Hills, Calif.

[73] **Assignee:** LaserMedics, Inc., Stafford, Tex.

[21] **Appl. No.:** 233,426

[22] **Filed:** Apr. 28, 1994

[51] **Int. Cl.<sup>6</sup>** ..... A61N 5/00

[52] **U.S. Cl.** ..... 607/89; 606/3; 606/9; 606/13

[58] **Field of Search** ..... 607/88-90; 606/3, 606/9, 13

[56] **References Cited**

#### U.S. PATENT DOCUMENTS

4,612,604	9/1986	Schluter .	
4,686,979	8/1987	Gruen et al. .	
4,686,986	8/1987	Fenyo et al. ....	607/90
4,836,203	6/1989	Müller et al. .	
4,930,504	6/1990	Diamantopoulos et al. .	
4,973,848	11/1990	Kolobanov et al. .	
4,989,605	2/1991	Rossen .	
5,011,483	4/1991	Sleister .	
5,029,581	7/1991	Kaga et al. .	
5,050,597	9/1991	Daikuzono .	
5,062,842	11/1991	Tiffany .	

5,071,416	12/1991	Heller et al. .	
5,123,902	6/1992	Müller et al. .	
5,130,997	7/1992	Ortiz et al. .	
5,150,704	9/1992	Tatebayashi et al. .	
5,161,526	11/1992	Hellwing et al. .	
5,217,455	6/1993	Tan .	
5,222,953	6/1993	Dowlatsahi .	
5,231,984	8/1993	Santana-Blank .	
5,246,436	9/1993	Rowe .	
5,312,395	5/1994	Tan et al. ....	606/3 X
5,344,434	9/1994	Talmore ....	607/88

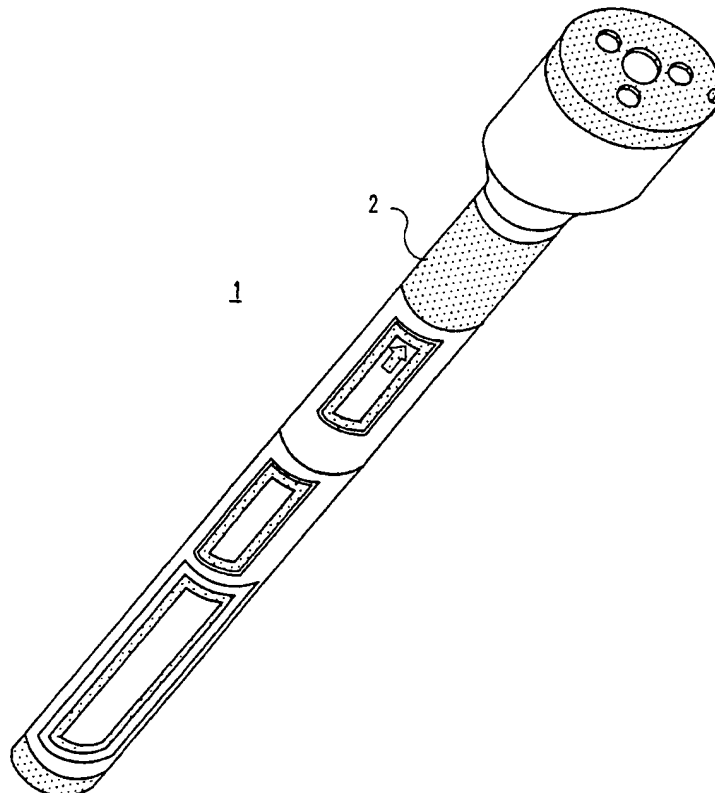
*Primary Examiner*—Angela D. Sykes

*Attorney, Agent, or Firm*—Whitham, Curtis, Whitham & McGinn

[57] **ABSTRACT**

A method of treating a patient, includes providing a laser source for emitting a laser light, diagnosing an afflicted area of the patient, delivering the laser light to the afflicted area for at least one treatment cycle, the laser source being operable on the afflicted area at a level of 1 Joule/cm<sup>2</sup> per treatment cycle, monitoring the afflicted area after the treatment cycle has been completed, and repeating the steps of diagnosing and delivering the laser light to the afflicted area based on the monitoring step. Each treatment cycle preferably has a duration of 33 seconds and the wavelength of the laser light is preferably between a range of 800–870 nm, and more preferably is substantially 830 nm.

20 Claims, 5 Drawing Sheets





US006032071A

**United States Patent** [19]  
**Binder****[11] Patent Number: 6,032,071**  
**[45] Date of Patent: Feb. 29, 2000****[54] SKIN EXAMINATION DEVICE****[75] Inventor: Michael Binder, Vienna, Austria****[73] Assignee: Norbert Artner, Vienna, Austria****[21] Appl. No.: 08/849,439****[22] PCT Filed: Nov. 28, 1995****[86] PCT No.: PCT/AT95/00231****§ 371 Date: May 30, 1997****§ 102(c) Date: May 30, 1997****[87] PCT Pub. No.: WO96/16698****PCT Pub. Date: Jun. 6, 1996****[30] Foreign Application Priority Data**

Dec. 1, 1994 [AT] Austria ..... 2233/94

**[51] Int. Cl.<sup>7</sup> ..... A61B 5/00****[52] U.S. Cl. .... 600/476; 356/369; 606/9****[58] Field of Search ..... 600/473, 476,  
600/407, 408; 606/9, 10; 356/369; 382/128;  
128/922, 925****[56] References Cited****U.S. PATENT DOCUMENTS**

4,398,541 8/1983 Pugliese .  
4,556,057 12/1985 Hiruma et al. .  
4,693,255 9/1987 Beall .  
4,768,513 9/1988 Suzuki .  
4,930,872 6/1990 Convery .  
5,054,502 10/1991 Courage .  
5,146,923 9/1992 Dhawan .  
5,198,875 3/1993 Bazin .  
5,363,854 11/1994 Martens et al. .  
5,596,992 1/1997 Haaland et al. .

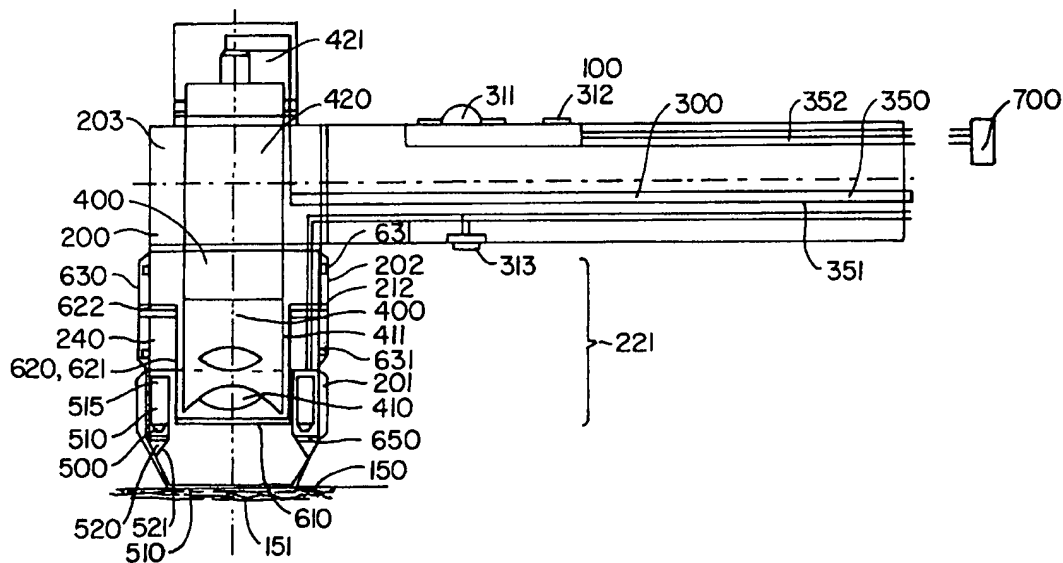
5,647,368 7/1997 Zeng et al. .  
5,653,706 8/1997 Zavislan et al. .  
5,701,902 12/1997 Vari et al. .  
5,734,739 3/1998 Sheehan et al. .  
5,735,276 4/1998 Lemelson .  
5,742,392 4/1998 Anderson et al. .  
5,769,076 6/1998 Maekawa et al. .  
5,835,620 11/1998 Kaplan et al. .  
5,836,877 11/1998 Zavislan .  
5,842,995 12/1998 Mahadevan-Jansen et al. .  
5,848,177 12/1998 Bauer et al. .  
5,851,181 12/1998 Talmor .  
5,860,967 1/1999 Zavislan et al. .

**FOREIGN PATENT DOCUMENTS**

0 475 803 A1 3/1992 European Pat. Off. .  
2 658 410 8/1991 France .  
94 17 828 U 12/1994 Germany .

**Primary Examiner—Marvin M. Lateef****Assistant Examiner—Shawna J Shaw****Attorney, Agent, or Firm—Townsend and Townsend and  
Crew LLP****[57] ABSTRACT**

A device for optical examination of human skin and its pigmentation comprises a cylindrical housing in which are arranged an optical observation device and a vertical illumination device. Where it faces the skin the housing is delimited by a plate made of transparent plastics or glass, which is applied to a skin site to be examined without introducing an immersion fluid. Light polarization devices are situated between the illumination device and the transparent plate and between the transparent plate and the optical observation device, their degree of polarization being controlled or, optionally, their location being movable mechanically into or out of particular light beam paths.

**32 Claims, 10 Drawing Sheets**



US006059820A

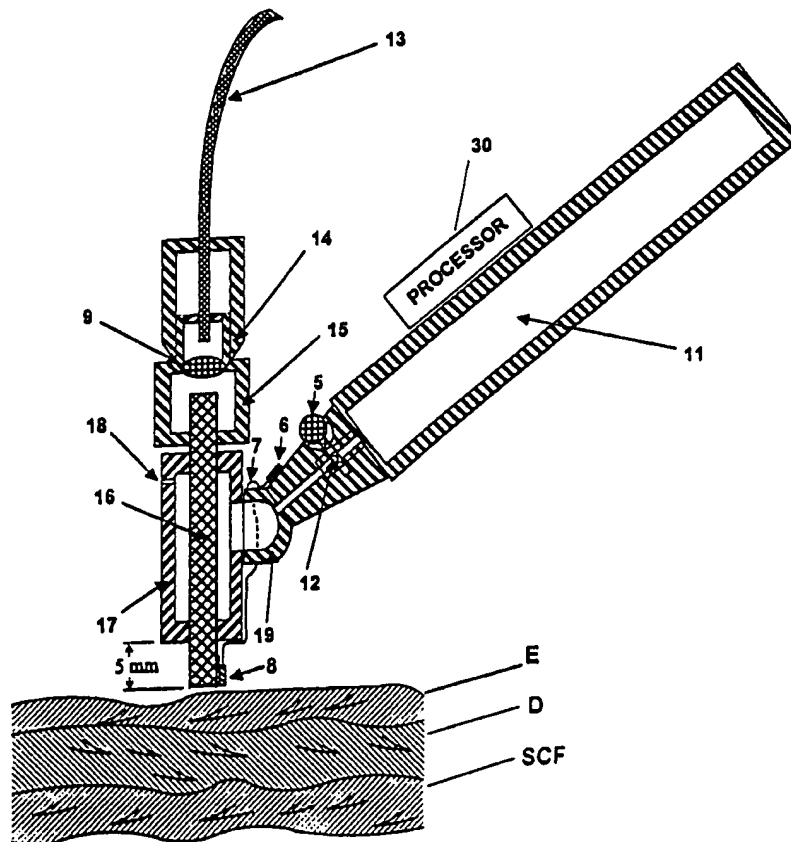
**United States Patent** [19]**Baronov**[11] **Patent Number:** **6,059,820**[45] **Date of Patent:** **May 9, 2000**[54] **TISSUE COOLING ROD FOR LASER SURGERY**

5,902,299 3/1999 Jayaraman ..... 606/20

[75] **Inventor:** Eugene Baronov, San Diego, Calif.*Primary Examiner*—Linda C. M. Dvorak*Assistant Examiner*—Soyu Han-Ogugua*Attorney, Agent, or Firm*—John R. Ross; John R. Ross, III[73] **Assignee:** Paradigm Medical Corporation,  
Newport Beach, Calif.[57] **ABSTRACT**[21] **Appl. No.:** 09/174,065[22] **Filed:** Oct. 16, 1998[51] **Int. Cl.<sup>7</sup>** ..... A61N 21/00[52] **U.S. Cl.** ..... 607/89; 606/9; 606/20[58] **Field of Search** ..... 606/9, 10, 11,  
606/12, 13, 14, 15, 16, 17, 20; 607/88,  
89, 90[56] **References Cited****U.S. PATENT DOCUMENTS**

4,376,376	3/1983	Gregory	606/22
5,334,016	8/1994	Goldsmith et al.	606/10
5,344,418	9/1994	Ghaffari	606/9
5,486,172	1/1996	Chess	606/20
5,735,844	4/1998	Anderson et al.	606/9
5,810,801	9/1998	Anderson et al.	606/9
5,814,040	9/1998	Nelson et al.	606/9
5,820,626	10/1998	Baumgardner	606/15

A laser treatment device and process with controlled cooling. The device contains a rod with high heat conduction properties, which is transparent to the laser beam. A surface of the rod is held in contact with the tissue being treated and other surfaces of the rod are cooled by the evaporation of a cryogenic fluid. The cooling is coordinated with the application of the laser beam so as to control the temperatures of all affected layers of tissues. In a preferred embodiment useful for removal of wrinkles and spider veins, the rod is a sapphire rod. A cryogenic spray cools the walls. A first surface is in contact with the skin surface being treated and an opposite surface is contained in an anticondensation oil chamber that is optically connected to a laser beam delivering fiber optic cable. In this preferred embodiment the temperature of the rod is monitored with a thermocouple which provides a feedback signal to a processor which controls the cooling and the laser power to provide proper regulation of temperatures at all affected tissue layers.

**13 Claims, 7 Drawing Sheets**

[54] **LASER DEVICE WITH ARTICULATED ARM**

[75] Inventor: Uzi Sharon, Tel-Aviv, Israel

[73] Assignee: Laser Industries Ltd., Ramat-Aviv, Israel

[22] Filed: Oct. 17, 1973

[21] Appl. No.: 407,047

[30] **Foreign Application Priority Data**

Oct. 17, 1972 Israel..... 40603

[52] U.S. Cl. .... 128/303.1

[51] Int. Cl.<sup>2</sup> ..... A61B 17/36

[58] Field of Search..... 128/303 R, 303.1, 395;  
331/94.5

[56] **References Cited**

**UNITED STATES PATENTS**

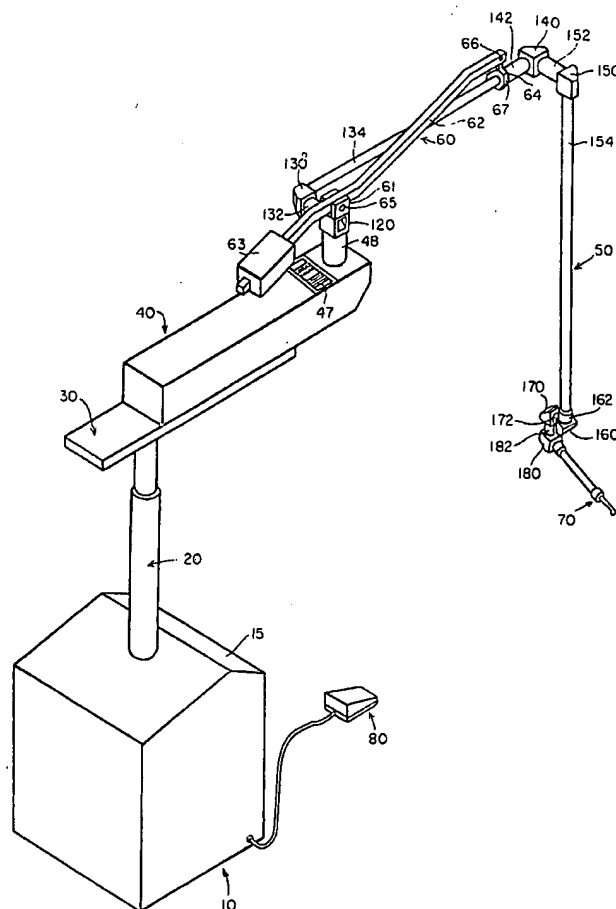
3,348,547	10/1967	Kavanagh.....	128/303.1 UX
3,481,340	12/1969	McKnight et al.....	128/395
3,703,176	11/1972	Vassiladis et al.....	128/395
3,720,213	3/1973	Hobart et al.....	128/395

Primary Examiner—Lawrence W. Trapp  
Attorney, Agent, or Firm—Pennie & Edmonds

[57] **ABSTRACT**

Apparatus for conducting a laser beam from a laser, through an articulated arm, to an output device, said apparatus being constructed so that the output device is easily maneuvered. In one embodiment, a beam from a laser mounted on an optical bench is directed to a first mirror that reflects the beam upward along the axis of a vertical shaft. At the top of the shaft, a second mirror, mounted on a conical bearing and rotatable about the axis of the vertical shaft, reflects the laser beam along the axis of a horizontal sleeve to a third mirror that is mounted on a sleeve bearing so that it is rotatable about the horizontal axis. In like fashion, the beam from the third mirror is successively incident on fourth, fifth, sixth, seventh, and eighth mirrors all of which are rotatable about the axis of the shaft down which the incident beam propagates. Finally, the beam from the eighth mirror enters the output device. The second through eighth mirrors are all mounted in the articulated arm and are interconnected by sleeve bearings and, in some cases, hollow tubes. The arm is supported by a counterbalancing system that is connected to the arm at a point between the third and fourth mirrors.

22 Claims, 5 Drawing Figures



[54] METHOD FOR LASER DEPILATION

[76] Inventors: Howard R. Weissman, 9216  
Middlebelt, Livonia, Mich. 48150;  
Joseph Mantel, 21819 Constitution,  
Southfield, both of Mich. 48076

[21] Appl. No.: 265,878

[22] Filed: May 21, 1981

[51] Int. Cl.<sup>3</sup> ..... A61N 5/00

[52] U.S. Cl. .... 128/303.1; 128/355;  
128/398

[58] Field of Search ..... 128/303.1, 395-398,  
128/355

[56] References Cited

U.S. PATENT DOCUMENTS

3,538,919	11/1970	Meyer	128/398
3,653,384	4/1972	Swope	128/395
3,693,623	9/1972	Harte et al.	128/398 X
3,720,213	3/1973	Hobart	128/395
3,834,391	9/1974	Block	128/398 X
3,865,113	2/1975	Sharon et al.	128/325

FOREIGN PATENT DOCUMENTS

2260016	3/1974	Fed. Rep. of Germany	128/303.1
2827639	1/1979	Fed. Rep. of Germany	128/303.1

OTHER PUBLICATIONS

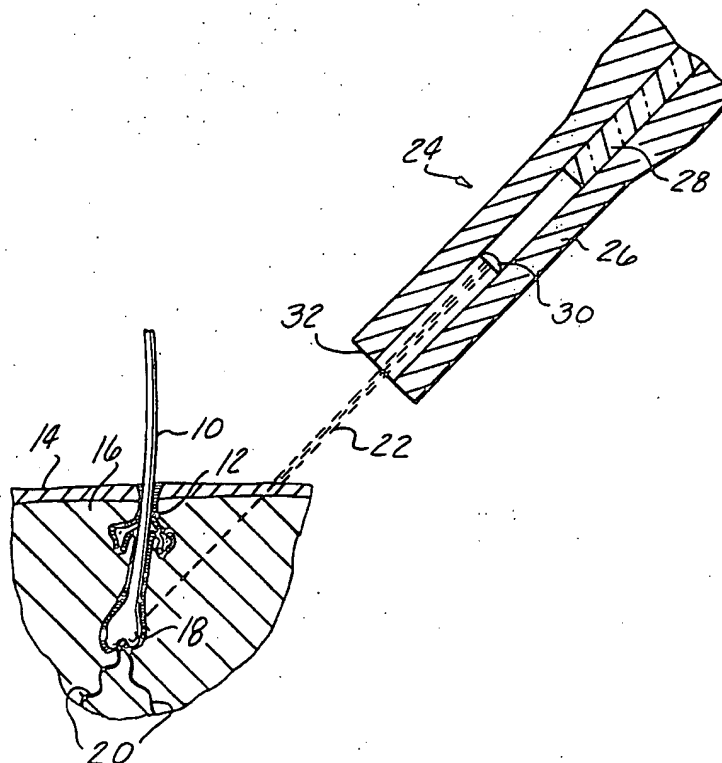
Liben et al., "An Argon Laser Photocoagulator", APL  
Tech. Digest, vol. 11, No. 3, Jan.-Feb. 1972, pp. 2-14.

Primary Examiner—Lee S. Cohen  
Attorney, Agent, or Firm—Krass, Young & Schivley

[57] ABSTRACT

The roots of human hairs of a patient are devitalized using high intensity, short duration pulses of light having wavelengths with respect to which the skin of the patient is non-absorbative and the hair of the patient is relatively absorbative. A narrow, focused beam of the light is aimed at the epidermis of the patient adjacent the hair such that an extension of the beam intersects the hair root at an angle relative to the skin surface. A short pulse passes through the skin and is absorbed in the hair root, destroying its blood supply. Apparatus for practicing the method employs a manually controlled two-axis positioning system supporting the focusing system that is connected to a laser light source by a flexible fiber optic bundle. A shutter selectively positionable in the optical path allows a low intensity beam to be produced for aiming and the shutter is removed from the optical path for the pulse period to produce the high energy beam.

7 Claims, 4 Drawing Figures



United States Patent [19]  
Simon

US005182857A  
[11] Patent Number: 5,182,857  
[45] Date of Patent: Feb. 2, 1993

- [54] SHAVING APPARATUS  
[75] Inventor: Pal Simon, Warstein, Fed. Rep. of Germany  
[73] Assignee: U.S. Philips Corp., New York, N.Y.  
[21] Appl. No.: 679,077  
[22] PCT Filed: Oct. 29, 1990  
[86] PCT No.: PCT/EP90/01929  
§ 371 Date: Sep. 3, 1991  
§ 102(e) Date: Sep. 3, 1991  
[87] PCT Pub. No.: WO91/06406  
PCT Pub. Date: May 16, 1991

- [30] Foreign Application Priority Data  
Nov. 2, 1989 [DE] Fed. Rep. of Germany ..... 3936367  
[51] Int. Cl.<sup>5</sup> ..... A61B 17/00  
[52] U.S. Cl. .... 30/34.05; 30/140;  
132/118; 606/9  
[58] Field of Search ..... 30/140, 32, 34.05;  
606/9, 19, 13; 132/118

- [56] References Cited  
U.S. PATENT DOCUMENTS  
3,693,623 9/1972 Harte et al. .... 606/9  
4,617,926 10/1986 Sutton ..... 606/9

4,819,669 4/1989 Politzer ..... 132/118  
5,057,104 10/1991 Chess ..... 606/9  
5,059,192 10/1991 Zaias ..... 606/9  
5,065,515 11/1991 Iderosa ..... 30/140

FOREIGN PATENT DOCUMENTS

3220962 12/1983 Fed. Rep. of Germany ..... 606/9

OTHER PUBLICATIONS

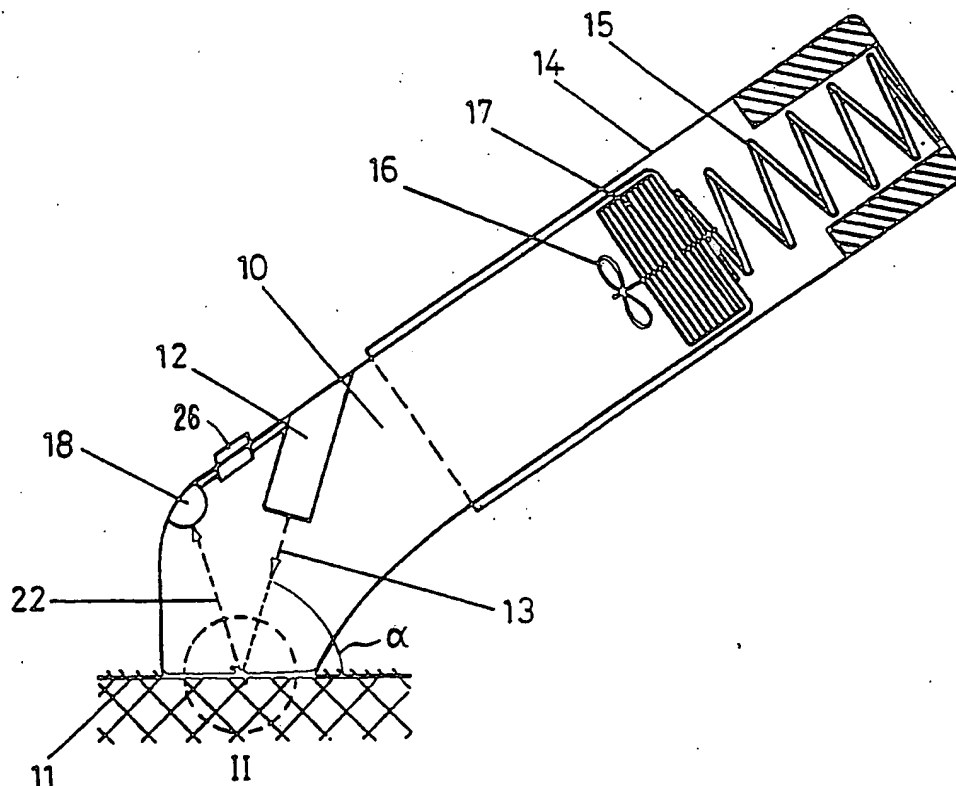
"The Laser Razor" at p. 38 of The Space Age Razor Race, Jaffe et al., MAD, Band. 208, Jul. 1979.

Primary Examiner—Douglas D. Watts  
Assistant Examiner—Hwei-Siu Payer  
Attorney, Agent, or Firm—Ernestine C. Bartlett

[57] ABSTRACT

The invention relates to a shaving apparatus which is characterized in that a laser beam (13) serves as the cutting means, and to a method of removing body hairs by means of such a shaving apparatus. The shaving apparatus comprises a shear plate (11) with an entry slot (24). The laser beam (13) is generated by a device (12), severs the hair in the proximity of the entry slot, and is preferably reflected from the shear plate and detected by a photo-cell (18). The shaving apparatus in accordance with the invention enables body hairs to be severed without irritating the skin.

10 Claims, 3 Drawing Sheets







US006074382A

**United States Patent** [19]

Asah et al.

[11] **Patent Number:** **6,074,382**[45] **Date of Patent:** **Jun. 13, 2000**[54] **APPARATUS FOR TISSUE TREATMENT**[75] Inventors: **Bjarne Asah, Taastrup; Olav Balle-Petersen, Humlebæk, both of Denmark**[73] Assignee: **Asah Medico A/S, Hvidovre, Denmark**[21] Appl. No.: **08/974,429**[22] Filed: **Nov. 19, 1997**[30] **Foreign Application Priority Data**

Aug. 29, 1997 [DK] Denmark ..... 0989/97

[51] Int. Cl.<sup>7</sup> ..... **A61B 17/36**[52] U.S. Cl. .... **606/9; 606/10; 606/11; 606/12**[58] Field of Search ..... **606/3, 10, 11, 606/12, 14, 15, 16, 17**[56] **References Cited****U.S. PATENT DOCUMENTS**

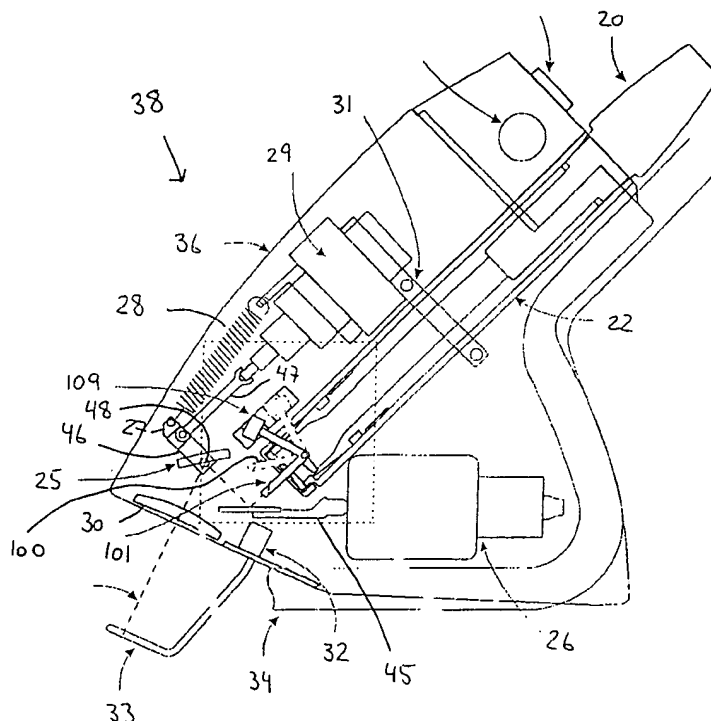
4,913,132	4/1990	Gabriel .....	606/17
5,474,549	12/1995	Ortiz et al. ....	606/17
5,531,740	7/1996	Black .....	
5,628,744	5/1997	Coleman et al. .	
5,653,706	8/1997	Zavitslan et al. .	
5,743,902	4/1998	Trost .....	606/11
5,779,702	7/1998	Fard .....	606/1
5,814,040	9/1998	Nelson et al. .	
5,836,939	11/1998	Negus et al. ....	606/17
5,860,968	1/1999	Wojcik et al. ....	606/10

**FOREIGN PATENT DOCUMENTS**

0763371A2	3/1997	European Pat. Off. .
0783904A2	7/1997	European Pat. Off. .
0788765A1	8/1997	European Pat. Off. .
0827716A2	3/1998	European Pat. Off. .
3837248A1	5/1990	Germany .
WO9400194	1/1994	WIPO .
WO9625979	8/1996	WIPO .
WO9824514	6/1998	WIPO .
WO9825528	6/1998	WIPO .

**Primary Examiner**—Linda C. M. Dvorak**Assistant Examiner**—Sonya Harris-Ogugua**Attorney, Agent, or Firm**—Birch, Stewart, Kolasch & Birch, LLP[57] **ABSTRACT**

An apparatus for tissue treatment is provided, comprising a light emitter for emission of a first light beam, director for directing the first light beam towards a target area to be treated, detector for detecting at least one tissue parameter at the target area, and first light beam controller for controlling at least one parameter without interruption of the propagating light beam. The tissue parameter may be selected from the group of texture, elasticity, size and shape. The apparatus may be used for ablating a thin epidermal layer of the derma of a patient and also marks on the tissue such as marks from chloasma, liver spots, red spots, tattoos, blood vessels just below the surface, etc. as well as warts, wounds, hair follicles, etc. may be ablated or treated.

**34 Claims, 9 Drawing Sheets**



US005595568A

**United States Patent** [19]

Anderson et al.

[11] **Patent Number:** 5,595,568[45] **Date of Patent:** Jan. 21, 1997[54] **PERMANENT HAIR REMOVAL USING OPTICAL PULSES**[75] Inventors: **R. Rox Anderson**, Lexington; **Melanie Grossman**, Boston; **William Farinelli**, Danvers, all of Mass.[73] Assignee: **The General Hospital Corporation**, Boston, Mass.[21] Appl. No.: **382,122**[22] Filed: **Feb. 1, 1995**[51] Int. Cl.<sup>6</sup> ..... **A61N 5/06**[52] U.S. Cl. .... **606/9**[58] Field of Search ..... **606/9, 10, 11, 606/12, 17, 14, 15, 16**[56] **References Cited****U.S. PATENT DOCUMENTS**

3,538,919	11/1970	Meyer et al.	128/398
3,693,623	9/1972	Harte et al.	
3,834,391	9/1974	Block	
3,900,034	8/1975	Katz et al.	128/395
4,461,294	7/1984	Baron	

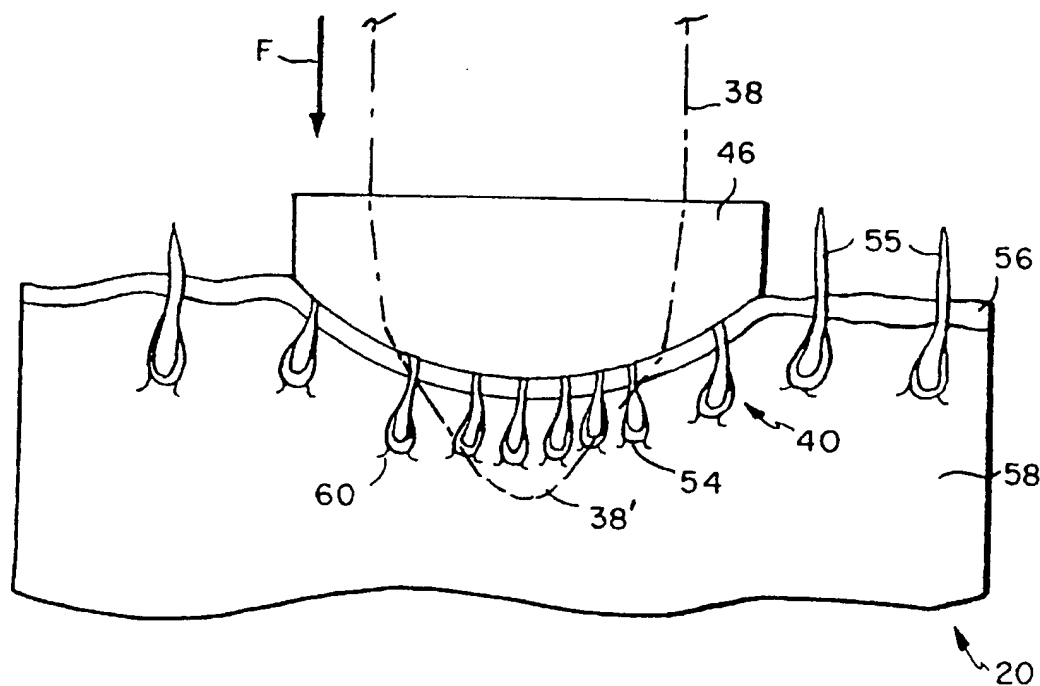
4,608,978	9/1986	Rohr	
4,617,926	10/1986	Sutton	
5,000,752	3/1991	Hoskin et al.	606/9
5,057,104	10/1991	Chess	609/9
5,282,797	2/1994	Chess	609/9
5,425,728	6/1995	Tankovich	606/9
5,474,549	12/1995	Ortiz et al.	606/9
5,486,172	1/1996	Chess	606/9

**FOREIGN PATENT DOCUMENTS**

WO86/02783 9/1986 WIPO.

*Primary Examiner*—Angela D. Sykes*Assistant Examiner*—Sonya Harris-Ogugua*Attorney, Agent, or Firm*—Wolf, Greenfield & Sacks, P.C.[57] **ABSTRACT**

A method and apparatus for simultaneously removing multiple hair follicles from a skin region of a patient. The method includes the step of illuminating the hair follicles with a large-area, optical radiation field by way of a transparent contact device proximal to the skin region. This allows portions of the hair follicles to be heated and then removed, while the surrounding skin region is left relatively free of injury.

**22 Claims, 7 Drawing Sheets**



US006306128B1

(12) **United States Patent**  
**Waldman et al.**

(10) **Patent No.:** **US 6,306,128 B1**  
**(45) Date of Patent:** **\*Oct. 23, 2001**

(54) **COOLING APPARATUS FOR CUTANEOUS TREATMENT EMPLOYING A LASER AND METHOD FOR OPERATING SAME**

(75) **Inventors:** **Amir Waldman, Hod Hasharon; Michael Slatkine, Herzlia; Ofer Braude, Ramat Gan; Arie Klein, Kfar Saba; Yitzhak Rozenberg, Tel Aviv; Jerry Talpalariu, Petach Tikva, all of (IL)**

(73) **Assignee:** **Laser Industries Ltd., Tel Aviv (IL)**

(\*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

5,330,519	7/1994	Mason et al. .	
5,336,217	8/1994	Buyss et al. .	
5,344,418	9/1994	Ghaffari .	
5,368,590	11/1994	Iton .	
5,405,368	4/1995	Eckhouse .	
5,486,172	1/1996	Chess .	
5,505,726	4/1996	Meserol .	
5,507,740	4/1996	O'Donnell, Jr. .	
5,595,568	1/1997	Anderson .	
5,683,380	11/1997	Eckhouse et al. .	
5,704,905 *	1/1998	Jensen et al. ....	602/58
5,713,890 *	2/1998	Chasan ....	606/1
5,735,844	4/1998	Anderson .	
5,741,245	4/1998	Cozean et al. .	
5,814,040 *	9/1998	Nelson et al. ....	606/9
5,849,029	12/1998	Eckhouse et al. .	
5,885,273	3/1999	Eckhouse et al. .	
5,909,978 *	6/1999	Giordano et al. ....	401/188

#### OTHER PUBLICATIONS

(21) **Appl. No.:** **09/252,870**

(22) **Filed:** **Feb. 8, 1999**

#### Related U.S. Application Data

(62) Division of application No. 08/729,240, filed on Oct. 9, 1996, now Pat. No. 5,868,732.

(51) **Int. Cl.<sup>7</sup>** ..... **A61B 18/18**

(52) **U.S. Cl.** ..... **606/9; 606/13; 606/16; 607/89**

(58) **Field of Search** ..... **606/1, 9, 13, 16; 401/188; 607/88-91**

(56) **References Cited**

#### U.S. PATENT DOCUMENTS

4,529,087 *	7/1985	Neal et al. ....	206/328
4,665,912 *	5/1987	Burton .	
5,057,104	10/1991	Chess .	
5,059,192	10/1991	Zaia .	
5,133,708	7/1992	Smith .	
5,143,071	9/1992	Keush et al. .	
5,226,907	7/1993	Tankovich .	
5,282,797	2/1994	Chess .	

Selective Cooling of Biological Tissues: Application for Thermally Medicated Therapeutic Procedures, B. Anvari, et al., Phys. Med. Biol. 40 (1995) 241-252.

Cool Laser Optics Treatment of Large Telangiectasia of The Lower Extremities, J. Dermatol. Surg. Oncol. (1993), pp. 74-80.

\* cited by examiner

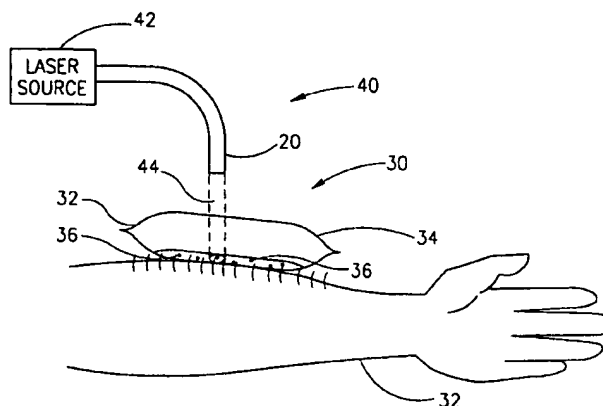
*Primary Examiner*—Roy Gibson

(74) *Attorney, Agent, or Firm*—Eitan, Pearl, Latzer & Cohen-Zedek

(57) **ABSTRACT**

Apparatus and method for tracking the operation of a light beam, preferably a laser light beam, which operates to treat the skin of the patient. The apparatus includes plurality of markings in accordance with the light beam impinges on the locations to be treated. The apparatus including the plurality of markings may be a cooling apparatus which also cools the skin during the treatment.

**24 Claims, 4 Drawing Sheets**





US005868732A

**United States Patent** [19]

Waldman et al.

[11] **Patent Number:** **5,868,732**[45] **Date of Patent:** **Feb. 9, 1999**

[54] **COOLING APPARATUS FOR CUTANEOUS TREATMENT EMPLOYING A LASER AND METHOD FOR OPERATING SAME**

[75] Inventors: Amir Waldman, Hod Hasharon; Michael Slatkine, Herzlia; Ofer Braude, Ramat Gan; Arie Klein, Kfar Saba; Yitzhak Rozenberg, Tel Aviv; Jerry Talpalariu, Petach Tikva, all of Israel

[73] Assignee: ESC Medical Systems, Ltd., Yokneam, Israel

[21] Appl. No.: 729,240

[22] Filed: Oct. 9, 1996

[30] Foreign Application Priority Data

May 12, 1996 [IL] Israel ..... 118229

[51] Int. Cl.<sup>6</sup> ..... A61B 17/36

[52] U.S. Cl. .... 606/9

[58] Field of Search ..... 606/1, 2, 4, 5, 606/6, 10, 11, 12, 14, 15, 16, 17

[56] **References Cited**

U.S. PATENT DOCUMENTS

5,133,708 7/1992 Smith ..... 606/5

5,143,071	9/1992	Keush et al. ....	128/640
5,282,797	2/1994	Chess .....	606/9
5,336,217	8/1994	Bays et al. ....	606/9
5,368,590	11/1994	Itoh .....	606/4
5,486,172	1/1996	Chess .....	606/20
5,505,726	4/1996	Meserol .....	606/9
5,507,740	4/1996	O'Donnell, Jr. ....	606/4
5,595,568	1/1997	Anderson et al. ....	606/9
5,683,380	11/1997	Eckhouse et al. ....	606/9
5,741,245	4/1998	Cozean et al. ....	606/5

*Primary Examiner*—Max Hindenburg

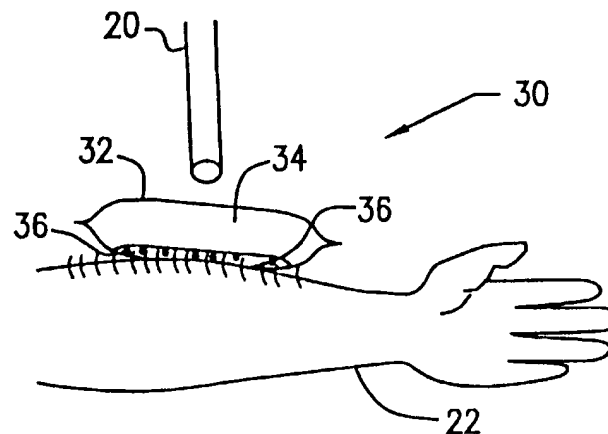
*Assistant Examiner*—Sonya Harris-Ogugua

*Attorney, Agent, or Firm*—Richard I. Samuel, Esq.;  
Friedman Siegelbaum LLP

[57] **ABSTRACT**

Apparatus and method for tracking the operation of a light beam, preferably a laser light beam, which operates to treat the skin of the patient. The apparatus includes plurality of markings in accordance with the light beam impinges on the locations to be treated. The apparatus including the plurality of markings may be a cooling apparatus which also cools the skin during the treatment.

**12 Claims, 4 Drawing Sheets**





US006090101A

**United States Patent** [19]

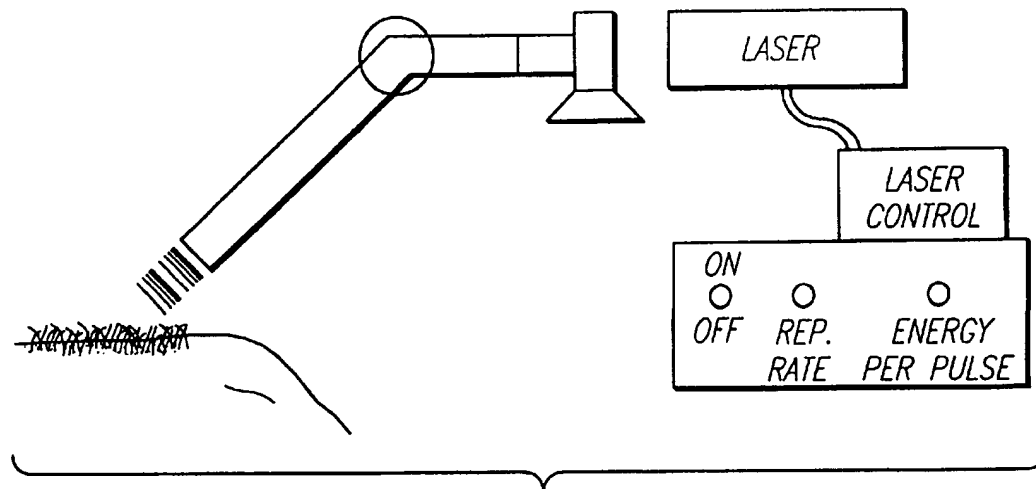
Quon et al.

[11] **Patent Number:** **6,090,101**[45] **Date of Patent:** **Jul. 18, 2000**[54] **METHOD AND APPARATUS FOR  
PERMANENT HAIR REMOVAL**[76] Inventors: **David K. Quon; Hew W. Quon;  
Wanda A. Quon**, all of 808 N. Hill St.,  
Los Angeles, Calif. 90012[21] Appl. No.: **08/987,956**[22] Filed: **Dec. 10, 1997**[51] **Int. Cl.<sup>7</sup>** ..... **A61B 17/36**[52] **U.S. Cl.** ..... **606/9**[58] **Field of Search** ..... 606/9, 10, 11,  
606/12, 14, 2, 15, 16, 17, 133, 134, 34,  
35, 36, 41, 42, 43[56] **References Cited****U.S. PATENT DOCUMENTS**

4,484,924	11/1984	Pfleiderer et al.	8/94.14
5,011,679	4/1991	Spanier et al.	424/57
5,669,916	9/1997	Anderson	606/133

*Primary Examiner*—Linda C.M. Dvorak*Assistant Examiner*—Sonya C. Harris*Attorney, Agent, or Firm*—Kleinberg & Lerner, LLP;  
Marvin H. Kleinberg[57] **ABSTRACT**

A permanent hair removal method includes the steps of preparing the surface of the skin, including the removal of excess hair and the application of suitable cleansers and degreasers. Alkaline ions, in a gel, cream, ointment or solution containing a buffered solution of potassium carbonate and sodium bicarbonate are applied to the clean, prepared surface. Apparatus using massage, ultrasound or other treatment modalities, promotes the penetration of the alkaline ions into the skin and hair follicles. The alkaline ions are then heated in situ through the use of a radiant energy source apparatus such as, for example, a laser, an infra red lamp or other high intensity light source. Radiant energy can also be provided by microwave or diathermy sources. The heated alkaline ions will then destroy all hair cells that are encountered.

**27 Claims, 3 Drawing Sheets**



US005725522A

United States Patent [19]  
Sinofsky

[11] Patent Number: 5,725,522  
[45] Date of Patent: \*Mar. 10, 1998

[54] **LASER SUTURING OF BIOLOGICAL MATERIALS**

[75] Inventor: Edward L. Sinofsky, Dennis, Mass.

[73] Assignee: Rare Earth Medical, Inc., W. Yarmouth, Mass.

[\*] Notice: The term of this patent shall not extend beyond the expiration date of Pat. No. 5,207,670.

[21] Appl. No.: 479,950

[22] Filed: Jun. 7, 1995

**Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 327,583, Oct. 24, 1994, Pat. No. 5,540,677, which is a continuation of Ser. No. 57,000, May 3, 1993, abandoned, which is a continuation-in-part of Ser. No. 804,791, Dec. 9, 1991, Pat. No. 5,207,670, which is a continuation-in-part of Ser. No. 538,977, Jun. 15, 1990, Pat. No. 5,071,417.

[51] Int. Cl.<sup>6</sup> ..... A61N 5/06

[52] U.S. Cl. .... 606/8; 606/229; 606/9; 606/144; 606/148

[58] Field of Search ..... 606/2, 3, 8-17, 606/213-216, 219, 220, 144, 147, 148, 150, 228, 229; 607/88, 89; 604/304-306

[56] **References Cited**

**U.S. PATENT DOCUMENTS**

655,190	8/1900	Bramson	606/216
3,272,204	9/1966	Artandi et al.	128/334
3,988,782	11/1976	Dradik et al.	3/1

(List continued on next page.)

**FOREIGN PATENT DOCUMENTS**

0 214 712	3/1987	European Pat. Off.
0618 115	8/1978	U.S.S.R.
0618 116	8/1978	U.S.S.R.
1 091 933	5/1984	U.S.S.R.
2 108 282	5/1983	United Kingdom
WO 92/12673	8/1992	WIPO

**OTHER PUBLICATIONS**

Barnes, N.P. et al. (1979) "TEM mode Ho: YLF laser" *SPIE* 190(LASL Optics Conference):297-304.

Grubbs, Jr., P.E. (1988) "Enhancement of CO<sub>2</sub> Laser Microvascular Anastomoses by Fibrin Glue" *J. Surgical Research* 45:112-119.

Hermati, H. (1988) "Compact Ho: YLF Laser" *Nasa Tech Brief* 12(6) Item #154.

Kamiji, T. et al. (1989) "Microvascular anastomosis using polyethylene glycol-4000 and fibrin glue" *British J. Plastic Surgery* 42:54-58.

Oz, M.C. et al. (1989) "In Vitro Comparison of Thulium-Holmium-Chromium: YAG and Argon Ion Lasers for Welding of Biliary Tissue" *Lasers in Surgery and Medicine* 9:249-252.

Popp, H.W. et al. (1989) "Welding of Gallbladder Tissue With a Pulsed 2.15  $\mu$ m Thulium-Holmium-Chromium: YAG Laser" *Lasers in Surgery and Medicine* 9:155-159.

(List continued on next page.)

Primary Examiner—Jennifer Bahr

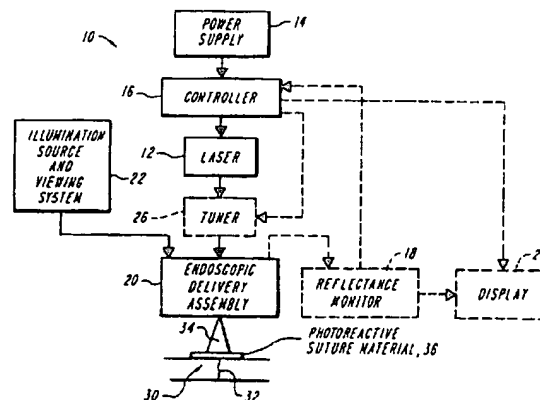
Assistant Examiner—Stephen Huang

Attorney, Agent, or Firm—Thomas J. Engellenner; Lahive & Cockfield, LLP

[57] **ABSTRACT**

Methods and systems for endoscopic suturing of biological tissue are disclosed. Endoscopic instruments are described which serve to position a suture material at an anastomotic site and deliver laser radiation to the suture material to effect fusion. The suture material includes a structure adapted for positioning at an anastomotic site and has at least a portion of the structure formed by a photoreactive crosslinking agent, such that upon irradiation of the structure the crosslinking agent adheres to the biological material. In one embodiment, the suture material can also include a high tensile strength element which is coated with a laser activatable crosslinking agent or glue. Upon activation, the suture material creates a desired closure or joiner of the biological material and is left in place while the endoscope is advanced to another target site or removed.

16 Claims, 4 Drawing Sheets





US005738679A

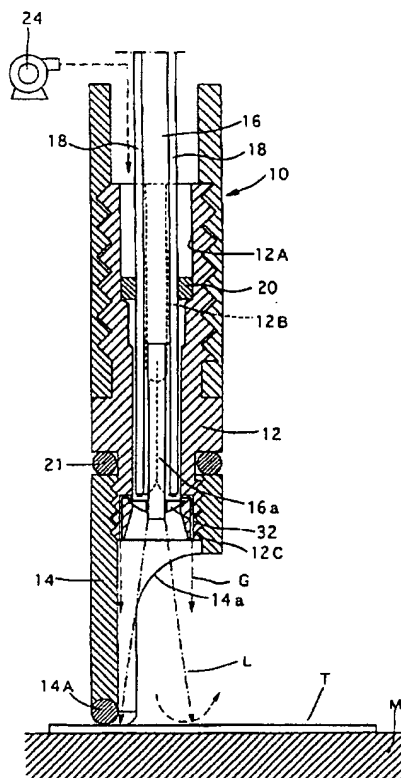
**United States Patent** [19][11] **Patent Number:** **5,738,679****Daikuzono**[45] **Date of Patent:** **Apr. 14, 1998****[54] APPARATUS FOR LASER TREATMENT FOR LIVING TISSUE**[75] **Inventor:** Norio Daikuzono, Cincinnati, Ohio[73] **Assignee:** S.L.T. Japan Company Limited,  
Tokyo, Japan[21] **Appl. No.:** 670,361[22] **Filed:** Jun. 26, 1996[51] **Int. Cl.<sup>6</sup>** ..... A61B 17/36[52] **U.S. Cl.** ..... 606/11; 606/9[58] **Field of Search** ..... 606/4, 5, 6, 13,  
606/14, 10, 11, 12, 17, 18**[56] References Cited****U.S. PATENT DOCUMENTS**

5,246,435	9/1993	Bille et al.	606/6
5,360,424	11/1994	Klopotek	606/4
5,364,390	11/1994	Taboada et al.	606/10
5,437,657	8/1995	Epstein	606/4

*Primary Examiner*—Jennifer Bahr*Assistant Examiner*—Sonya Harris-Ogugua*Attorney, Agent, or Firm*—Andrus, Scales, Starke &  
Sawall**[57] ABSTRACT**

The present invention is used for irradiating the entire of nevus on the skin with laser light uniformly and efficiently to remove it.

A laser treating apparatus for living tissue the present invention comprises a laser light generator; a main optical fiber for receiving the laser light from said laser light generator to irradiate the surface of the living tissue with the laser light; a plurality of optical fiber bundle which is annularly disposed around the main optical fiber and having the front ends facing the surface of the tissue; laser light switching means between said laser light generator and said laser light transmitting means; a first light quantity detecting means for measuring the quantity light which has been emitted from said laser light transmitting means and has been reflected on the surface of the tissue; second light quantity of detecting means for measuring the quantity of laser light reflected on a predetermined area on said surface of the tissue; and irradiation control means for impinging the laser light from said laser light generator upon said laser light transmitting means by actuating said switching means when the irradiation of laser light is determined necessary based upon the ratio ( $I_m/I_r$ ) of the second light quantity  $I_m$  measured by said second light quantity detecting means to the first light quantity  $I_r$  measured by said first light quantity detecting means which is used as an index representing whether or not unirradiated area is present, reirradiation is necessary.

**10 Claims, 9 Drawing Sheets**



US005820625A

**United States Patent** [19]

Izawa et al.

[11] **Patent Number:** **5,820,625**[45] **Date of Patent:** **Oct. 13, 1998**[54] **LIGHT DEPILATING APPARATUS**[75] Inventors: **Yoshihiro Izawa; Iwao Yamazaki**, both of Tokyo, Japan[73] Assignee: **Ya-man Ltd.**, Tokyo, Japan[21] Appl. No.: **755,569**[22] Filed: **Nov. 27, 1996**[30] **Foreign Application Priority Data**

Sep. 26, 1996 [JP] Japan ..... 8-009690 U

[51] Int. Cl.<sup>6</sup> ..... **A61B 17/36**[52] U.S. Cl. .... **606/9; 606/13; 607/88**[58] Field of Search ..... **606/3, 9-13; 607/88-89**[56] **References Cited****U.S. PATENT DOCUMENTS**

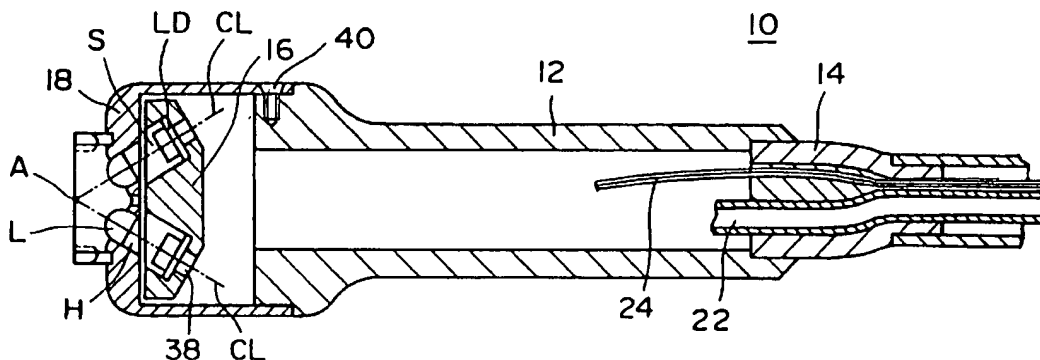
5,409,482 4/1995 Diamantopoulos ..... 606/13

5,683,380 11/1997 Eckhouse et al. .... 606/9

5,683,436 11/1997 Mendes et al. .... 607/88

*Primary Examiner*—John P. Lacyk*Assistant Examiner*—Roy Gibson*Attorney, Agent, or Firm*—Kane, Dalsimer, Sullivan, Kurucz, Levy, Eisele and Richard, LLP[57] **ABSTRACT**

A light depilating apparatus comprising a light depilating probe, an electric controller, and a connection cable for connecting the light depilating probe to the electric controller whereby the light depilating probe is brought into contact with a portion of skin to be depilated; wherein the light depilating probe includes: a hollow body; a head cap having opened and closed ends and being attached at its opened end to one end portion of the body so as to form an inner space in the head cap; a transparent contacting cylinder provided on a head of the head cap at its closed end so that the cylinder is brought into contact with skin; a holding block provided in the inner space of the head cap; a connection cap provided at the other end portion of the body to hold a terminal of the cable connected to the electric controller; a plurality of light-emitting sources constituted by semiconductor laser elements mounted in holes formed in the holding block so as to be excited by the electric controller through electric conductors; holes provided in the closed end of the head cap so that light paths are formed through the holes of the holding block and the holes in the head cap respectively so as to make all the light beams emitted from the light-emitting sources are focused to one focal point within an outside end surface of the contacting cylinder which is brought into contact with skin.

**9 Claims, 2 Drawing Sheets**





US005860967A

**United States Patent** [19]

Zavislan et al.

[11] **Patent Number:** 5,860,967[45] **Date of Patent:** Jan. 19, 1999

[54] **DERMATOLOGICAL LASER TREATMENT SYSTEM WITH ELECTRONIC VISUALIZATION OF THE AREA BEING TREATED**

[75] **Inventors:** James M. Zavislan; Jay M. Eastman, both of Pittsford, N.Y.

[73] **Assignee:** Lucid, Inc., Henrietta, N.Y.

[21] **Appl. No.:** 94,296

[22] **Filed:** Jul. 21, 1993

[51] **Int. Cl.<sup>6</sup>** ..... A61N 5/02

[52] **U.S. Cl.** ..... 606/9; 606/10; 606/12; 607/89

[58] **Field of Search** ..... 606/9-13, 16-18; 607/89

[56] **References Cited****U.S. PATENT DOCUMENTS**

3,538,919	11/1970	Meyer .	
3,693,623	9/1972	Harte et al. .	
3,834,391	9/1974	Block .	
4,289,378	9/1981	Remy et al. .	
4,388,924	6/1983	Weissman et al. .	
4,617,926	10/1986	Sutton .	
4,733,660	3/1988	Itzkan .....	606/9
4,786,155	11/1988	Fantone et al. .	
4,901,718	2/1990	Bille .	
5,059,192	10/1991	Zaias .	
5,112,328	5/1992	Tabaoda et al. .	
5,336,217	8/1994	Buxs et al. ....	606/9

**OTHER PUBLICATIONS**

Selective Photothermolysis: Precise Microsurgery by Selective Absorption of Pulsed Radiation, "Science," vol. 220.  
 The IRIS Medical Diode Laser Indirect Ophthalmoscope  
 OcuLight® SLx Diode Laser System.  
 The OcuLight® SL Diode Photocoagulator IRIS Medical  
 Endo Probes™.  
 Keeler Ophthalmic—Cover Page, pp. 1-4 & back of cover  
 Hexascan Brightens the Future for Millions of People.

The Lihtan Hexascan™ CVL Network News—Spring 92.  
 Metalaser Technologies—Network News, Winter, 1992.  
 Metalaser Technologies—Network News—Winter 92.  
 Autolase™ Scanner—1991 Metalaser Technologies, Inc.  
 Clinical Summery of Copper Vapor Laser Treatment of  
 Dermatologic Disease: A Private Practice Viewpoint—  
 Harold A. Lancer, M.D., F.A.A.D.

*Primary Examiner*—Michael Peffley

*Attorney, Agent, or Firm*—M. Lukacher; K. Lukacher

[57] **ABSTRACT**

A hand held microsurgical instrument for applying laser energy to selected locations (sites) in an area under the skin (or other exposed translucent tissue) to provide localized photothermolysis of underlying tissue at these sites, is described. The laser energy is focused into a spot within the tissue. This spot is of sufficiently small size so that the energy density is sufficient to provide surgical or treatment effects within the tissue without damaging the surface tissue. In dermatology, for example, the technique can be used to destroy endothelial cells in blood vessels which are desired to be removed, such spider veins (nevi) in the skin, hair follicles to prevent hair growth therefrom, or other microsurgical procedures. The area is visualized while the laser beam is steered, using a deflection system, in X and Y coordinates. A telecentric optical system, in which a mirror of the deflection system is located, directs the laser light essentially perpendicular to the area to be treated as the beam is scanned over the area. The optical system also focuses illumination light reflected from the area to a sensor matrix of a CCD video camera. The reflected illumination light is imaged essentially parallel to the optical axis in the object space thereby providing a precise, high resolution image corresponding to the area. The laser beam may be tracked as it is deflected over the area to the selected locations by visualization thereof on a display or monitor associated with the video camera. The locations are then apparent to the treating physician who can then effect an increase of the beam power or turn the beam on so as to treat the tissue in the selected locations.

**30 Claims, 9 Drawing Sheets**

